Distr.
GENERAL

UNCTAD/DST/7
25 April 1995

Original: ENGLISH
ENGLISH, FRENCH AND
SPANISH ONLY

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

REPORT OF THE WORKSHOP ON SELECTED COOPERATION ASPECTS FOR TECHNOLOGICAL CAPACITY-BUILDING IN DEVELOPING COUNTRIES

(Geneva, 10-11 April 1995)

Sponsored by the Technology Partnership Initiative (TPI),
Department of Trade and Industry (DTI), and the
Overseas Development Administration (ODA), United Kingdom,
and the Division for Science and Technology, UNCTAD

GE.95-51508

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I. BACKGROUND, OBJECTIVES AND PROGRAMME OF THE WORKSHOP

A. Background

1. On 10 and 11 April 1995, the Technology Partnership Initiative (TPI) of the Department of Trade and Industry (DTI), together with the Overseas Development Administration (ODA), United Kingdom, and the UNCTAD secretariat's Division for Science and Technology convened a Workshop in Geneva. The purpose of the Workshop was to examine selected cooperation aspects for technological capacity-building in developing countries, with special emphasis on least developed countries (LDCs), and to explore ways of applying new strategies such as technology partnerships for effectively increasing technological capacities in developing countries. The Workshop also received support from the Government of the Netherlands, which provided UNCTAD with resources to undertake specific reports in technological capacity-building in selected least developing countries.

2. The organization of the Workshop responds to requests made by the UNCTAD Ad Hoc Working Group on the Interrelationship between Investment and Technology Transfer. In the course of its work, the Ad Hoc Working Group pointed out that the problems faced by the least developed countries needed special attention and that these countries should put forward their problems and concerns, thus providing a basis for discussion and possible follow-up. The Working Group recommended specifically that UNCTAD should undertake a project specially designed to foster technological capacity-building in the least developed countries, and, in so doing, seek the expertise and support of the international community. It should report on the results of the project to the appropriate intergovernmental machinery of UNCTAD.

3. The Ad Hoc Working Group further recommended that UNCTAD should assist developing countries in fostering entrepreneurship through the transfer of technology and managerial skills, and in developing a framework of mechanisms for technology partnerships between enterprises, with special attention to small and medium-sized enterprises (SMEs) and their representative organizations. Creative partnerships among firms and between firms and organizations of the R&D system are important tools for expanding trade and developing technological capabilities. Such partnerships involve the blending of capital, technology, marketing, skills and raw material resources. These new forms of collaboration are more common in the North. The question of how to promote new forms of technological collaboration with the South is critical, and an important ingredient in this venture is the potential role of SMEs as suppliers and recipients of technology.

4. The Workshop is part of a series of events organized by the UNCTAD secretariat's Division for Science and Technology to address different aspects of technological innovation in developing countries, including industrial districts (Geneva, 1992), university-enterprise cooperation in Latin America (Buenos Aires, 1993), the transfer and development of environmentally sound technologies (Oslo, 1993) and R&D community-enterprise cooperation and commercialization in the Asian region.[1]

B. Objectives

5. The Workshop's main objectives were to (a) examine and recommend specific modalities for follow-up action to foster the technological capacity-

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[1]The latter was organized together with UNCTAD's Division for Economic Cooperation among Developing Countries and Special Programmes (ECDC), in cooperation with the Asian and Pacific Centre for Transfer of Technology (APCTT) (New Delhi, 1994).

building of a selected number of least developed countries, and (b) identify and recommend ways and means for initiating technological partnerships between SMEs of developed and developing countries, with a view to defining proposals for their promotion. Its ultimate objective was to identify appropriate routes to technological capacity-building in developing countries, whether least developed or more technologically advanced.

6. Participants were invited to contribute papers considering, *inter alia*, the following issues: (a) with regard to technological capacity-building: the effect of current economic trends on strategies for technological development; relation of S&T policy to macroeconomic and industrial policies; role of public and private sectors; strengthening the institutional infrastructure; new initiatives including those of the international community; (b) with regard to technology partnership: partnerships as an instrument to foster entrepreneurship through effective technology transfer and development of managerial skills; lessons drawn from experiences of cooperation between SMEs from developing and developed countries; obstacles faced in the process of initiating partnerships; human resource elements; the development of processes and products; possible policy instruments and action-oriented proposals (see annex 2 for the list of contributions submitted to the Workshop).

7. The papers prepared for the Workshop will be found in a separate document entitled Technology Capacity-Building and Technology Partnership: Field Findings, Country Experiences and Programmes (UNCTAD/DST/6).

8. The detailed work programme of the Workshop is found in annex 1.

C. Participants and officers of the Workshop

9. Participants included experts from developing and developed countries, such as representatives from a wide range of public and private institutions and from the enterprise sector, as well as experts involved in national, regional and international technological cooperation (see annex 3 for the list of participants).

10. The meeting was chaired by Ambassador Hugo Cubillos of Chile, now representing his country in Sweden. He was assisted by two Rapporteurs, Professor Samuel Wangwe, from the United Republic of Tanzania, and Professor Carlo Pietrobelli, from Italy.

II. HIGHLIGHTS OF THE DISCUSSIONS AND RECOMMENDATIONS

11. The key points and main recommendations emerging from the presentations prepared for the Workshop and the subsequent exchange of views are briefly set out below. They relate respectively to technology capacity-building, with special emphasis on the least developed countries, and to technological partnership between SMEs from developed and developing countries.

A. Technological capacity-building

12. The Workshop reasserted the view that technological capacity-building is vital for economic development and requires, among other things, physical inputs, skills, information, services, interaction among different economic actors, a favourable economic, institutional and legal environment, transfer of technology and managerial skills, and mechanisms for internalizing technology as well as for the creation of technology partnerships.

13. A number of developing countries are undergoing structural adjustment and economic reforms oriented towards a market economy and private sector development, and are thus, in many ways, passing through a period of transition. In this context emphasis was laid on the importance of examining the impact on least developed countries (LDCs) of structural adjustment,

including privatization policies, and the effect of import liberalization on domestic industrial development and on technological capacity-building.

14. There are indications that gaps are emerging in private sector development and in the facilitation role of the State. This new role of the State has not acquired the promotional characteristics that are necessary for private sector development. While considerable progress has been made in macroeconomic policy stabilization, the link between macro-level policy and micro-level activities for fostering technology capacity-building remains tenuous. This link can be strengthened by State facilitation and the creation of institutional mechanisms to manage the process of reorientation towards a market economy. At all levels the role of the State and other institutions in facilitating the development of micro-level activities and providing the necessary technology-related infrastructural support deserves greater attention, in particular, supportive mechanisms for education and training. Governments should assist in the creation of infrastructure to meet services demands from enterprises. Support from the donor community to LDCs will be needed in this context.

15. The Uruguay Round Agreement provides opportunities for LDCs to build domestic capacities in critical areas that would enhance their ability to benefit from the new trading system. Consistent with article 66 of the Agreement on trade-related intellectual property rights (TRIPs), the developed countries are expected to provide incentives to their enterprises and institutions for purposes of promoting and encouraging transfer of technology to LDCs to enable them to enhance their technological capacities. However, a mechanism to this end is not provided for in the Marrakesh Agreement. Support for improving investment conditions and strengthening regional and subregional technology and market links would be instrumental in fostering technological capacity-building and in enhancing participation in the new trading environment.

16. The LDCs are already facing acute constraints on the resources needed to foster technological capacity-building. The implementation requirements of TRIPs place an additional burden on these countries in terms of financial and administrative capacities. Incorporating the new provisions in the national legislation and creating an administrative capacity to manage law enforcement and implementation of enforcement procedures will make undue demands on the already overstretched financial and human resources. The challenge that confronts these countries in endeavouring to foster and reward enterprise development, including stimulation of investment and technology flows, calls for efforts and resource commitments that are beyond what LDCs can sustain over time.

17. The importance was stressed of adapting science and technology (S&T) policies to the new international environment and effectively integrating them into national economies and society. While S&T policy should be at the centre of any government policy, it should also be coordinated with, and not isolated from, other related policies, for example, with trade, education, and industrialization. The importance of effective implementation of policies was also underlined. Particular emphasis should be placed on policies at the meso-level (that is, policies which assist in implementing macro-economic policies at the micro-level), the introduction of new elements which broaden the scope of S&T policies, including not only research and development (R&D) in the traditional sense but also its applied and user-oriented forms, the involvement of actors such as chambers of commerce and industry, technology institutions and users of technology, and the diffusion and extension of technology. It was noted that actors at different levels (public, private business and social networks) will have an important role to play. It was stressed that appropriate institutional mechanisms for facilitating consultations between government and the private sector (and other relevant development actors) will need to be established.

18. The Workshop noted the overriding importance of education, vocational training systems and human resources development in general. In view of the

growing international market for scientists and engineers, some participants suggested that training should be done *in situ* to avoid the consequences of brain drain. Other participants emphasized the need to include training abroad, while creating incentives to provide a conducive environment for the trainees' return. Emphasis was laid on the importance of restructuring the educational system and vocational training systems to cope with the changing requirements of new and emerging technologies. The educational system should be able to instil a technology culture from its earliest levels.

19. The linkage between academia, R&D institutions and industry will need to be revisited with a view to reducing the gaps between them. R&D institutions should be restructured to reflect the needs of users more effectively, and users should be assisted to become better informed about the activities and capabilities of R&D institutions. In this connection it will be important to set up an incentive structure that will encourage enterprises to continue searching for technological improvements based on their own efforts, the efforts of local R&D institutions and technology sources in other countries.

20. In the view of the participants, there is a need to look at the incentives that will induce industrial enterprises, including SMEs, to continue to innovate or to seek to upgrade their technologies and introduce new technologies. It is also necessary to explore systematically options which facilitate transfer of technology, including environmentally sound technologies, by examining new sources of global revenues, market mechanism options, investment and trade agreements, regulatory systems, national tax and tariff systems and development assistance programmes.

21. The importance of venture capital for technology innovation and dissemination was emphasized, together with the need for effective links between financing, S&T institutions and SMEs.

22. Emphasis was laid on the importance of information on available technologies, including environmentally sound technologies, and of networking. Proactive action was regarded as important for enabling enterprises in developing countries to gain easier access to technology information as well as for facilitating the establishment of information networks between local firms and institutions in the country concerned and between them and institutions in developed countries and other developing countries.

23. There is a current realization of the importance of the environmental dimension in the international transfer of technology, including training and information sourcing; in this context, the evaluation of environmental performance and of technology transfer in developing countries is vital. Attention was drawn in this respect to the experience of the Technology Partnership Initiative (TPI) of the United Kingdom. The success with which environmentally sound technologies are implemented will very much depend on their profitability potential, their efficiency effects and their perceived ability to enable the implementing firms to access export markets.

24. The Workshop was of the view that developing countries, particularly the least developed countries, need to harness science and technology to enable them to meet the basic needs of the people and to develop their international competitiveness in selected export activities. The balance between these two objectives has to be addressed, especially in the context of global liberalization and rapid technological advancement. Nevertheless, in some developing countries little or no attention has been paid to redressing this balance in the S&T policies. Comprehensive S&T policy reviews would help not only to set such policy in the context of broader development and economic policies, but hopefully to enable a balance to be achieved. In order to monitor the progress made towards achieving the stated objectives, assistance in undertaking such periodic reviews would be useful. The experiences of OECD countries in carrying out such policy reviews may be of interest in this respect.

25. The Workshop felt that potential donor countries could participate in the formulation and implementation of action plans for capacity-building, making resources and expertise available on the basis of a joint commitment for action by both donors and recipient developing countries. Plans of this kind could also be implemented in response to recent concerns on improving aid effectiveness and aid coordination.

26. Developed countries could be partners in the process of creating technological capacities by building on the existing programmes for private sector development. In a number of OECD countries private sector development programmes have extended their focus to technological innovation and diffusion in the field of environment and related clean technologies. The experience of the OECD countries that have implemented development assistance and cooperation programmes in the technology aspects of environment would be useful. What is needed now is to broaden the scope of technology capacity-building in the existing private sector development programmes. The new broader scope should incorporate all technology efforts directed at fostering technological capacity-building in the LDCs.

27. A study of the relationship between development assistance programmes and technological capacity-building could be useful for the purpose of export promotion, credit facilitation and the adaptation of trade and of science and technology policies.

28. UNCTAD should undertake a programme incorporating mechanisms for following up and monitoring the implementation of the above recommendations with a view to fostering technological capacity-building particularly in the least developed countries. This should be done by seeking the expertise and support of the international community, and in coordination with the appropriate international organizations. The programme should consist of the following components:

(a) Revisiting the changing role of the State and designing ways in which the donor community could best enhance the capacity of the State to formulate policies linking macro-level policies to micro-level activities in S&T development, including the capacity to deliver infrastructural support services necessary for enterprise development, and to foster the activities of R&D institutions.

(b) A project to review the technology content of existing development assistance programmes concentrating on the private sector with a view to broadening their scope for fostering technological capacity-building.

(c) A pilot project to undertake science and technology policy reviews in selected interested countries.

(d) A project to explore the collaboration between firms in LDCs and in developed countries in the field of new and emerging technologies with special emphasis on the possibilities of building on existing technological capabilities.

(e) A project to assist LDCs to implement the decisions of the Uruguay Round Agreements relating to science and technology, and to deal with their consequences.

B. Technology partnerships

29. Substantial evidence from developed countries indicates that SMEs' efforts to pool their resources, information, technologies and skills have often had a positive impact on their competitiveness and industrial efficiency. The experiences of the Italian industrial districts, as well as of the clusters of SMEs in the Baden-Württenberg region represent only a few of the cases in point. Geographical proximity, the sharing of common values and attitudes, and the availability of technically skilled workers have generated a climate conducive to industrial innovation and inter-firm

cooperation. In turn, this has resulted in an accelerated process of learning and creation of technological capacities. It follows that the obstacles deriving from minimum production scale requirements, economies of scale, aspects concerning information, commercialization, technology acquisition and adaptation, that are often barriers to the achievement of industrial competence by SMEs, may be overcome by clustering and pooling resources. This option is likely to become more and more necessary in view of the removal of trade barriers, thereby widening the markets in which competition takes place at a global level.

30. Can this process of inter-firm technological cooperation be extended to firms in the developing world? The Workshop attempted to identify ways in which such a process may be achieved, how inter-firm technological cooperation may contribute to the creation and improvement of technological capacities in the developing countries and what role governments and international organizations may play to facilitate technology partnerships.

31. The Workshop recommended that the following matters should be addressed through both studies and specific pilot projects in the field.

1. Definition of a theoretical and operational concept of technological partnership between SMEs from industrial countries and developing countries

32. There is a growing consensus, also reflected in the academic literature, that technological partnerships need to be characterized by: (a) a two-way relationship; (b) a deliberate endeavour to cooperate, that may be fostered by government incentives or be the outcome of market mechanisms only, reflecting inter-firm complementarities of production assets, knowledge, marketing and distribution networks, etc.; (c) the sharing of technological knowledge through a variety of forms that may involve collaborative R&D, training, manufacturing and marketing functions; and also (d) an approach geared towards longer-term mutual benefits that go beyond short-term financial success.

33. Concerning the clarification of the *concept of technology partnership, and the underlying theoretical implications*, this implies emphasizing the difference between technology partnerships and the "strategic alliances" among industrial enterprises in developed countries. The object of the latter is to bring about joint investment efforts in R&D activities in order to generate innovations which contribute to a competitive edge. The Workshop viewed technology partnerships between enterprises from developed and developing countries as a long-term process of learning and partnering through an explicit engagement aimed at the realization of mutual benefits. This may involve technology-related training, the introduction of new management systems, the adaptation of technologies to prevailing circumstances, and of incremental improvements to product and process technology that increase plant-level productivity. Thus, a common subject of inter-firm transactions is the supply of machinery, technical assistance and technological know-how for operating at "best practice" levels of technical efficiency and for making the venture profitable.

34. *Making the concept of technology partnerships operational and applicable* to specific countries and economic sectors: this implies the identification of those characteristics that make SMEs from different countries potential technology partners; the definition of the forms that these agreements may take, and their suitability for specific enterprises, industries and technologies; the analysis of the relationship between the characteristics of a given technology (complexity, factor intensity, environmental sustainability) and the nature of a technology partnership; and the study of the usefulness of such partnerships that are geared to export development, and employ environmentally sound technologies.

35. The Workshop therefore recommended the design and realization of in-depth studies to further define the concept of technology partnership in

relation to entrepreneurial and technological capacity-building and to examine the possibilities of applying the concept in operational terms.

36. A plan of action for future activities should be carried out by UNCTAD. The first phase should include detailed analyses on the above inter-related elements, with field studies on specific regions/countries and sectors, as well as on specific forms of technology partnerships already experimented with in different parts of the world.

2. Conditions for successful technology partnership

37. In order to provide policy advice to governments and institutions (national and international) willing to sustain the development of effective technology partnerships, the Workshop considered that the conditions necessary for success need to be studied. These include the following:

38. *Macro-economic dimensions*: Host country conditions crucially affect the process of technology partnership design and implementation. Without a macro-economic environment enabling and conducive to such partnerships, no effective results will emerge. Thus, the host country needs to provide stable and credible macro-economic policies, efficient and competitive product and factor markets, and ensure that there is no bias in favour of specific enterprises (public vs. private, domestic vs. foreign). In short, there should be a pro-business environment, as technology partnerships need to be profitable ventures in order to attract the interest of all partners and be self-sustaining over time. Moreover, host country governments need to contribute to the improvement of the factor endowments at the national level, including, in particular, education and training of qualified human resources. However, this does not ensure that across-the-board liberalization will provide an enabling environment for technology partnerships, as the scanty evidence on agreements of this kind in developing countries reveals. In fact, the existence of market failures and imperfections needs to be carefully detected and remedied. For example, the educational system may fail to provide the right skills and specializations that industry demands or to supply them in sufficient quantities. The market for technology may be imperfect (limited alternatives for technology sourcing, asymmetric information between technology suppliers and users, lack of awareness of the need for explicit and costly efforts to master and assimilate new technologies, etc.) and necessitate remedies.

39. *Meso-economic dimensions*: Industrial enterprises do not operate in a "vacuum", but interact at an intermediate level through a dense network of transactions including within specific institutions. Thus, meso-policies are also an essential condition for the development of technology partnerships at the level of specific industries, regions and institutions. At a sectoral level, they reflect the different nature of technologies and of learning processes and requirements for specific industries.

40. *Enterprise-level (micro-economic) dimensions*: Developing country enterprises need a certain level of technological capacity and of efficiency to be interesting partners to SMEs from advanced countries. Thus, for example, if local SMEs already employ a qualified workforce and are in the habit of providing constant training opportunities for their workers, they qualify as potentially successful "would-be-partners". In this sense, effective policies favouring the development of technological capabilities have an important, complementary role to play in supporting technology partnerships. Moreover, if SMEs already enjoy a tradition of fruitful linkages with other firms and institutions, and are familiar with the complexities of interaction and collaboration, they are likely to represent potential candidates for partnerships with developed countries' SMEs.

41. All these conditions will have to be spelled out through detailed studies. International organizations such as UNCTAD have a central role to play in advising governments and international donors on policies creating the macro-, meso- and micro- conditions for successful technology partnerships.

Policy advice would include both assistance to define the policies required, and continuous and timely monitoring of their implementation.

3. A comprehensive approach to policies favouring technology partnerships

42. The promotion of effective technology partnerships between SMEs from developed and developing countries requires a comprehensive and global approach to policy. There are many examples of attempts to transfer elements of successful experiences of inter-firm technology linkages, e.g. model technical service centres, to other locations, where, in the absence of one or more of these elements, the transfer has proved incapable of producing comparable results. Specific instruments such as incubators, science parks, business communication centres, technical service centres, are only bricks in the overall fabric of sustainable technological and innovation development in SMEs. An appropriate policy must encompass all the necessary elements required in the particular location concerned. These may differ from place to place, but due account must be taken of specificities and of the interplay among the building bricks of effective technology partnering. Consideration is rarely given, for example, to the linkage between industry-specific technology capacities, the educational and training systems that have to provide the right human skills, and the industrial policies implemented. Global policies are therefore needed to support technology partnership operations, and governments and international donors are called upon to contribute in a variety of ways.

43. In this respect, the Workshop recommended that international organizations such as UNCTAD should provide technical advice in the identification of the complementarities and incompatibilities among the different building blocks of effective policy interventions to support technology partnerships, drawing upon concrete experiences and pilot case studies for this purpose.

4. Incentives affecting SMEs' technology partnering activities

44. No technology partnership will ever be sustainable if it is not rooted in a profit-making incentive. Governments should consider providing incentives to induce SMEs to undertake technology partnering, but, in the absence of sound long-term profitability, a technology partnership is not going to last or offer the expected benefits in terms of technological capacity-building and technology transfer. Therefore, the incentives that induce agents to set up inter-firm technology linkages should be spelled out. The following specific elements deserve focused attention.

45. The incentive for SMEs from developed countries to undertake technology partnering is based on an effective learning process accomplished by the partner from the developing country. In so far as the latter improves its efficiency over time and "learns", the incentive to cooperate in a long-run perspective may hold good for both parties. Thus, learning is the objective of a technology partnership and a condition for its success. At a policy level, this has to be encouraged in a variety of ways, to be defined by governments with the policy advice of relevant international organizations.

46. In addition, SMEs from developing countries can benefit substantially from partnerships involving environmentally sound technologies for at least two sets of reasons. First of all, through such partnerships they would be able to introduce substantial efficiency elements such as the elimination of waste. Secondly, markets are demanding imports that have been produced by the use of environmentally sound technologies.

47. The choice of entering a technology partnership is risky and characterized by many uncertainties. Only mutual knowledge and trust can reduce this risk and enhance the prospects for such a partnership between distant partners. A variety of institutions exists whose primary function is to build mutual trust and reduce risk for all would-be-partners. They may be a financial intermediary, a venture capital fund or a service supplier with

a good knowledge of many actors operating in the same territory and acting as a guarantee apart from the parties involved. For example, industrial districts in Italy owe much of their success to a well-established tradition of confidence that often overlaps with family relationships The existence of a tradition of cooperation and inter-firm linkages among developing countries' SMEs may reduce the risk of venturing into technology partnerships for SMEs from developed countries. Supporting developing countries to devise pilot activities that may have as their main objective the definition of institutional mechanisms to enhance mutual trust and confidence among would-be-partners may be an important function for organizations such as UNCTAD.

48. In addition, the potential advantages in terms of cost and effectiveness that may be derived from technology partnerships linking enterprises, including SMEs of the more advanced developing countries with those of the lesser developed countries (South-South transfers of technology), could also be examined. UNCTAD, in consultation with other appropriate institutions, should initiate a project designed to disseminate information on these possibilities and to promote pilot projects in this area.

49. As far as policy design is concerned, this implies that policies fostering inter-firm linkages within the developing countries, or within specific regions therein, may also raise the likelihood of SMEs from developed countries venturing into technology partnerships with developing country firms. Inter-regional cooperation may thus be favoured and supported with the final target of creating technology partnerships. The Workshop recommended that the institutional mechanisms to link up regions with similar characteristics in different countries might be explored by UNCTAD and proposed to interested governments. This would be justified by the systemic nature of effective technology partnerships, as one-to-one relationships reflecting the influence of a gamut of transactions with other entities in the respective environments. The experience of developed regions such as Emilia Romagna reveals that inter-firm partnerships have materialized from a whole system of formal and informal linkages developing simultaneously within the same area. UNCTAD should contribute to the definition of ways and mechanisms to foster relationships among industrial regions and areas in different countries, and among SMEs therein.

50. Noting the broad spectrum of problems associated with establishing such partnerships between individual SMEs, the Workshop recommended that efforts should be made to develop mechanisms to promote partnerships between existing clusters of firms. Partnerships between clusters may be focused on subject areas such as the environment, or specific sectors such as food production, tool and machinery manufacturing, etc.. Through pilot initiatives, this approach could also contribute insights useful in the framing of appropriate policies at a local or regional level to promote such partnerships. Additionally, it would assist in the capacity building of supporting institutions and agencies.

51. Information on the potential advantages of technology partnerships for the partners concerned is often scarce and hidden. An explicit objective of governments and international donors should be to minimize the cost of information on the possible advantages and drawbacks of international technology partnerships, and on specific potential partners in other countries operating in selected industries. Agencies effectively match-making interested partners should be supported. The fast rate of technological development requires a framework to be established to facilitate information dissemination and exchange, as well as continuous human resource development at the interface between R&D and industry and policy-makers.

52. In this context, the rapid advances in telecommunication and data-transmission technologies offer opportunities to redress the problem of technological development imbalances between developed and developing nations. UNCTAD may wish to consider the possibility of establishing and managing an electronic network dealing with technology partnership and related institutional capacity-building. This network could make use of Internet as

the carrier and would facilitate continuous interaction between the various actors and other networks, regional or global, that deal with similar or related topics.

53. In summing up its *recommendations*, the Workshop stressed the need to undertake the following, taking into account the specific considerations outlined above: (a) in-depth studies of policy-related aspects of technology partnerships with a view to further defining and making this concept operational and providing advice to interested governments. These analyses – to be carried out in association with institutions such as chambers of commerce and industry, business associations, service centres, financial intermediaries, training and R&D centres, and other S&T institutions – could cover special features of countries and regions, of economic sectors, and of industries and technologies; (b) a review of existing programmes that are currently supporting the match-making of enterprises from different regions and countries, and an assessment of their activities; and (c) the setting up of adequate infrastructures and mechanisms to foster access to information, including through electronic-based means.

III. SUMMARY OF MAIN CONCLUSIONS AND RECOMMENDATIONS

A. Technological capacity-building in developing countries with particular emphasis on least developed countries

54. Reasserting the view that technological capacity-building is vital for economic development, the Workshop stressed the importance of examining the impact of structural adjustment, including privatization policies, and the effect of import liberalization on domestic industrial development and on technological capacity-building in developing countries. The need for the adaptation of science and technology policies to the new international environment and their effective integration into the national economies and society, in coordination with other related policies concerning, for example, trade, education, industrialization and R&D, was emphasized. Developing countries, particularly the least developed countries, need to harness science and technology to meet both the basic needs of the people and to develop international competitiveness in selected export activities.

55. To cope with the changing requirements of new and emerging technologies, the Workshop recommended the restructuring of the educational and vocational training systems. The educational system should instil a technology culture from its earliest levels. The Workshop stressed the need for proactive action to enable enterprises in developing countries to gain easy access to information on available technologies, including environmentally sound ones, and for networking.

56. The Workshop also made recommendations concerning the need for the improvement of investment conditions; the introduction of applied and user-oriented forms of R&D; the involvement of various actors in the policy-making process, including chambers of commerce, technology institutions and users of technologies; the establishment of mechanisms for facilitating consultations between government and the private sector; and the strengthening of regional and subregional technological cooperation.

57. Developed countries could become partners in the creation of technological capacity by building on the existing programmes for private sector development, and broadening their scope to include specific technology-related objectives.

58. Least developed countries (LDCs) do not have the funds, trained human resources or infrastructure to pursue a technologically based innovation process on their own. Therefore, a level of cooperation that is qualitatively different from traditional technology transfer is needed. Such cooperation could take place through inter-firm and inter-organizational cooperative

programmes and projects, the integration of local technologies and suppliers, the enhancement of expertise, including in the field of engineering, and of the capacities to internalize, apply and commercialize local and foreign R&D effectively.

59. The Workshop further recommended that UNCTAD should undertake a programme in coordination with the appropriate international organizations and by seeking the expertise and support of the international community, to develop strategies for effectively assisting interested LDCs in technological capacity-building. The programme would include elements such as: (a) revisiting the changing role of the State and designing ways in which the donor community could best enhance the capacity to link macro-level policies to micro-level activities in S&T development, by for instance, delivering the infrastructural support services necessary for enterprise development, and to foster the activities of R&D institutions; (b) projects to review the technology content of existing development assistance programmes concentrating on the private sector with a view to broadening their scope for technological capacity-building; (c) a pilot project to undertake science and technology policy reviews in selected countries; (d) a project to explore collaboration between firms in LDCs and in developed countries in the field of new and emerging technologies, with special emphasis on the possibilities of building on existing technological capabilities; (e) a project to assist LDCs to implement the decisions of the Uruguay Round Agreement relating to science and technology, and to deal with their consequences.

B. Technology partnerships between developed and developing countries

60. Strategic alliances among firms and between firms and R&D institutions blending capital, technology, marketing efforts and raw material resources have become instruments in improving technological capacity-building in the industrialized countries over the past decade. The Workshop discussed how such approaches could be adapted to the situation in developing countries in order to establish long-term technological partnerships between firms from developed and developing countries as well as on a South-South basis. Partnerships of this type appear to be characterized by "two-way relationships" and by a long-term process of learning and partnering through an explicit engagement aimed at the realization of mutual benefits. This may involve technology-related training, the introduction of new management systems, the adaptation of technologies to prevailing circumstances and incremental improvements to product and process technology that increase productivity.

61. The Workshop noted that such initiatives needed an enabling environment at the macroeconomic, mesoeconomic and enterprise levels, including incentives, an adequate legal framework and improved education and qualification of human resources. Such an environment would provide a basis for small and medium-sized companies to establish mutually beneficial linkages through technological partnerships. A better coordinated and comprehensive approach is also required to link up often fragmented policies, such as science and technology and investment policies. The Workshop recommended that a variety of instruments such as incubators, business communication centres, technical service institutions and training programmes should be promoted to induce "would-be-partners" to join forces in the interests of technological capacity-building and of obtaining mutual benefits.

62. From the point of view of global environmental concerns, technology partnerships also have an important role to play. A variety of mechanisms are being established to this end, as, for instance, the Technology Partnership Initiative (TPI) of the United Kingdom, which reported on its experiences with training and information sourcing in the area of environmentally sound technologies (ESTs). The Workshop felt that SMEs from developing countries could benefit substantially from partnerships involving environmentally sound technologies. These would enable them to introduce newer, efficient technologies, making them more competitive in global markets, and assisting

them to meet environmental standards, which could become part of the import policies of developed countries.

63. The Workshop recommended that a plan of action for future activities in this domain should be carried out by UNCTAD in consultation with appropriate organizations concerned. This would involve the following: (a) in-depth studies of policy-related aspects of technology partnerships with a view to further defining and making this concept operational, providing advice to interested governments and initiating pilot projects in the field. These analyses - to be carried out in association with institutions such as chambers of commerce and industry, business associations, service centres, and other S&T institutions -could cover aspects such as motivations and incentives for partnering, special features of countries and regions, of economic sectors, and of industries and technologies; (b) a review of existing programmes currently supporting the match-making of enterprises from different regions and countries, with an assessment of their activities; and (c) the setting up of adequate infrastructures and mechanisms to foster access to information, including through electronic-based means.

Annex 1

Work programme

Monday, 10 April 1995

09.00	Opening of the Workshop - Introduction by Mr Pedro Roffe, Officer-in-Charge, Division for Science and Technology, UNCTAD - Statement by the Chairman - Statement by Ms Stella Blacklaws, Deputy Head of the Technology Partnership Initiative (TPI), Environment and Energy Technologies Division, United Kingdom
09.40-10.30	Approaches and recommendations to promote technological capacity-building in selected least developed countries (Bangladesh, Ethiopia, Nepal, United Republic of Tanzania)
11.00-13.00	Discussion
14.30-16.00	Technology partnership experiences
16.30-18:00	Discussion

Tuesday, 11 April 1995

09.00-10.00	Aspects concerning technological capacity-building in least developed countries Rapporteur's summary of discussions
10.30-12.30	Technology partnership experiences (continuation) Rapporteur's summary of discussions
14.30-16.00	Discussion of possible recommendations of the Workshop and of their implementation
16.30	Adoption of the Workshop's proposals for action

Annex 2

List of contributions presented to the Workshop

Experiences from developing countries

Barriers to the Transfer of Environmental Technologies in Argentine Industry by Carmen Longa Virasoro, President, Asociación para el Desarrollo de la Gestión Ambiental, Buenos Aires, Argentina

Experiences and Suggestions for Technological Capacity-building in Bangladesh by M. Waliuzzaman, ex Chairman, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh

Ethiopian Scenario for Technological Capacity-building by Getahun Tadesse, Department of Industry, Ethiopian Science and Technology Commission, Addis Ababa, Ethiopia

Building Technological Capacity in Developing Countries: the case of India by K.P. Nyati, Head, Environment Management Division, Confederation of Indian Industry, New Delhi, India

Aspects concerning Technological Capacity-building in Nepal by Ramananda Mishra, Joint Secretary, Ministry of Industry, Kathmandu, Nepal

Philippine Experience in Technological Capability-building for SMEs in the Area of Environmental Management and Sustainable Development by Grace Favila, Executive Director, Philippine Business for the Environment, Manila, Philippines

Technological Capacity-building Aspects in Tanzania by Titus Mteleka, Director of Science and Technology, Ministry of Science, Technology and Higher Education, Dar-es-Salaam, United Republic of Tanzania

Technological Capacity-building and Technology Partnership Aspects in Zimbabwe by Lewin Mombemuriwo, Director, National Cleaner Production Centre, Harare, Zimbabwe

Investment in Technological Capacity-building in Bangladesh and Nepal by Meine Pieter van Dijk, ING Bank International and Erasmus University, The Netherlands

Fostering Technological Capacity-building in the United Republic of Tanzania and Ethiopia by Samuel Wangwe, Executive Director, Economic and Social Research Foundation, Dar-es-Salaam, United Republic of Tanzania

Experiences from developed countries

Some Reflections on International Technology Partnerships between SMEs by Roger W. Short, Projects Director, Small Enterprise and Local Economic Development Association (SELEDA)

Technology Transfer from the Perspective of an Environmental Consultancy by Geoffrey S. Prosser, Managing Director, W.S. Atkins (Environment), United Kingdom

Environmental Technology Cooperation - Background to the Setting up of the Technology Partnership Initiative by Stella K. Blacklaws, Deputy Head of the Technology Partnership Initiative (TPI), Department of Trade and Industry, London, United Kingdom

Danish Programme Support to Technology Transfer by Poul Brath, Manager, Focal Point for Technology for Developing Countries, Danish Technological Institute, Taastrup, Denmark

A Danish Technology Partnership Programme: the Experience in Zimbabwe by Jens Kvorning, the Danish Federation of Small and Medium-sized Enterprises, Copenhagen, Denmark

Technological Capacity-building and Social Conditions: the Case of Emilia Romagna Region, Italy by Valeria Bandini, European and International Projects Department, Emilia Romagna Technological Development Agency (ASTER), Bologna, Italy

Supporting SMEs' Technology Transfer and Innovation - the Experience of ASTER by Paolo Bonaretti, Director, Emilia Romagna Technological Development Agency (ASTER), Bologna, Italy

Technology Transfer and Partnering Possibilities through the Software Approach - the Case of the Rhône Alpes Region in France: a Summary Note by François Ullmann, Director of International Projects, Training Unit, Grenoble Chamber of Commerce and Industry, France

Implications of the Global Information Highway for Developing Countries: Opportunities for Training and Technology Transfer by Günther Cyranek, Information Technology Assessment, Zurich

South-South Transfers of Technology to Small and Medium Enterprises in the Least Developed Countries by David Dichter and Klaus Netter, Technology for the People, Geneva

Experiences presented by international organizations

OECD Country Reviews of Science and Technology Policies by Jean-Eric Aubert, OECD, Paris

Technology Transfer, Co-operation and Capacity Development by the OECD Secretariat, Paris

Experiences with Partnership and Capacity-Building by John H. Skinner, Senior Advisor, UNEP Industry and Environment Centre, Paris

Building Critical Technological Capacities in Africa by T.S. Karumuna, Economic Affairs Officer, Science and Technology Section, ECA, Addis Ababa, Ethiopia

Selected Cooperation Aspects for Technological Capacity-building in Developing Countries in Asia and the Pacific by the ESCAP secretariat

APCTT's Experiences in Strengthening Regional Cooperation in Technological Capacity-building - with Emphasis on SMEs and Transfer of Environment-friendly Technologies by Jürgen Bischoff, Director, Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi, India

Technological Capacity-building in Least Developed and Other Low-income Countries: UNDP's Pilot Programmme in Science and Technology by Johann Baümler, Deputy Director, UNFSTD/STAPSD, UNDP, New York

Increasing Competitiveness and Technology Capacity-building among Small and Medium-sized Enterprises through Technological Partnership by the UNCTAD secretariat, Geneva

Annex 3

List of participants

Mr. Jean-Eric Aubert
Principal Administrator
Outlook and Country Studies Division
Directorate for Science, Technology and Industry
OECD
2, rue André Pascal
75775 Paris Cedex 16 - France
Tel 00 33 1 45249355
Fax 00 33 1 45249767

Ms. Valeria Bandini
European and International Projects Department
Emilia Romagna Technological Development Agency (ASTER)
Via Morgagni 4
I-40122 Bologna - Italy
Tel 00 3951 236242
Fax 00 3951 227803

Mr. Johann Bäumler
Deputy Director
UNFSTD/STAPSD
UNDP
One United Nations Plaza
New York, NY 10017 - USA
Tel 00 1 212 9066301
Fax 00 1 212 9065566

Mr. Jürgen Bischoff
Director
Asian & Pacific Centre for Transfer of Technology (APCTT)
P.O. Box 4575
New Delhi 110016 - India
Tel 00 91 11 6856276/6856255
Fax 00 91 11 6856274

Mr. Paolo Bonaretti
Director
Emilia Romagna Technological Development Agency (ASTER)
Via Morgagni 4
I-40122 Bologna - Italy
Tel 00 3951 236242
Fax 00 3951 227803

Mr. Poul Brath
Manager
Focal Point for Technology for Developing Countries
Danish Technological Institute
P.O.Box 141
DK-2630 Taastrup - Denmark
Tel 00 4543 504350
Fax 00 4543 504833

Mr. Carlos Maria Correa
Director de la Maestría en Política y Gestión
Ciencia y Tecnología
Centro de Estudios Avanzados
Universidad de Buenos Aires
Florida 439 - 20 Piso
1008 Buenos Aires - Argentina
Tel 00 54 1 311 05216
Fax 00 54 1 311 0516

Mr. Hugo Cubillos
Ambassador
Embassy of Chile
Sturegatan 8
11435 Stockholm - Sweden
Tel 00 468 6798280
Fax 00 468 6798540

Mr. Günther Cyranek
Information Technology Assessment
Auf der Mauer 3
8001 Zürich - Switzerland
Tel 0041 1 2603 111
Fax 0041 1 2603 111
Email Cyranek@ifi-rzu.unizh.ch

Mr. David Dichter
Director
Technology for the People
P.O.Box 2253
1211 Geneva - Switzerland
Tel 00 41 22 732 8926/738 1415
Fax 738 9776

Ms. Grace Favila
Executive Director
Philippine Business for the Environment
G/F, DAP Building
San Miguel Avenue, Pasig.
Metro Manila 1601 - Philippines
Tel 00 63 2 635-3670
Fax 00 63 2 631-5714

Mr. Dirk von Felbert
Development Cooperation Directorate
Economics and Environment Division
OECD
2, rue André Pascal
75775 Paris Cedex 16 - France
Tel 00 33 1 45248961
Fax 00 33 1 45241996

Mr. Laurent Guye
Chef de Section
Service du Développement
Office fédéral des Affaires économiques extérieures
3003 Berne - Switzerland
Tel 00 41 31 322 2294
Fax 00 41 31 382 3374

Mr. T.S. Karumuna
Economic Affairs Officer
Science and Technology Section
ECA
P.O.Box 3001
Addis Ababa - Ethiopia
Tel 00 251 1 517200
Fax 00 251 1 514416

Ms. Maria del Carmen Longa Virasoro
Presidente
Asociación para el Desarrollo de la Gestión Ambiental (ADEGA)
Av. Jean Jaures 315
1215 Buenos Aires - Argentina
Tel 00 54 1 7850605 (direct line)
Tel/Fax 00 54 1 8662100

Mr. Fernando Machado
Director
Technology Services
Investment and Technology Promotion Division
UNIDO
P.O.Box 400
A-1400 Vienna - Austria
Tel 0043 1 21131-3350
Fax 0043 1 2095332

Mr. Ramananda Mishra
Joint Secretary
Ministry of Industry
Singhadurbar
Kathmandu - Nepal
Tel 00 977 1 211217/16692
Fax 00 977 1 220319

Mr. Lewin Mombemuriwo
Director
National Cleaner Production Centre (NCPC)
c/o Delta Corporation
P.O.Box BW 294, Borrowdale
Harare - Zimbabwe
Tel 00 263 4 883865
Fax 00 263 4 883864

Mr. Titus Mteleka
Ministry of Science, Technology and Higher Education
P.O.Box 2645
Dar-es-Salaam
United Republic of Tanzania
Tel 00 255 51 27701-3 or 29247
Fax 00 255 51 46167/44244

Mr. Klaus Netter
Chief Economist
Technology for the People
P.O. Box 2253
1211 Geneva 1 - Switzerland
Tel 00 41 22 732 89 26
Fax 00 41 22 738 97 76

Mr. K.P. Nyati
Head
Environment Management Division
Confederation of Indian Industry
India Habitat Centre
4th Floor, Zone IV, Lodi Road
New Delhi 110003 - India
Tel 00 91 11 4691151/4602523
Fax 00 91 11 4602524

Mr. Geoffrey S. Prosser
W.S. Atkins Environment
Woodcote Grove
Ashley Road
Epsom, Surrey KT18 5BW
United Kingdom
Tel 00 44 1372 726140
Fax 00 44 1372 740055

Mr. Carlo Pietrobelli
Department of Economics and Institutions
University of Rome "Tor Vergata"
Via di Tor Vergata snc
00133 Rome - Italy
Tel 00 39 6 2040220-4
Home 00 39 6 3728691
Fax 00 39 6 2020500

Mr. Roger Short
Consultant
Roger Short & Associates/
SELEDA/ASTER
Songy, 74580 Viry - France
Tel 00 33 5004 7718
Fax 00 33 5004 7717

Mr. John Skinner
Senior Advisor
United Nations Environment Programme
Industry and Environment
Tour Mirabeau, 39-43
Quai André Citroën
75739 Paris Cedex 15 - France
Tel 00 33 1 44371450
Fax 00 33 1 44371474

Mr. Getahun Tadesse
Ethiopian Science and Technology Commission
P.O.Box 2490
Addis Ababa - Ethiopia
Tel 00 251 1 511344
Fax 00 251 1 518829

Mr. Meine Pieter van Dijk
ING Bank International
Financial Advisory & Consultancy Services
P.O.Box 1800 HE 04.01
1000 BV Amsterdam
The Netherlands
Tel 00 31 20 563 5459
Fax 00 31 20 563 5460

Mr. M. Waliuzzaman
ex Chairman
Bangladesh Council for Scientific and Industrial Research (BCSIR)
Qudrat Khuda Rd.
Dhaka 1205 - Bangladesh
Tel 00 8802 502000
Fax 00 8802 863022

Mr. Samuel M. Wangwe
Executive Director
Economic and Social Research Foundation
51 Uporoto Street
P.O.Box 31226 Kijitonyama
Dar-es-Salaam
United Republic of Tanzania
Tel 00 25551 71763/75115
Fax 00 25551 34723 - 255 811 324508

Organizers

Ms. Stella K. Blacklaws
Deputy Head of the Technology
Partnership Initiative (TPI)
Department of Trade and Industry
1 Palace Street
London SW1E 5HE - United Kingdom
Tel 00 44 171 215 1037/238 2738
Fax 00 44 171 215 1089

Ms. Estela Erb-Paniagua
Secretary
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9075644
Fax 00 41 22 9170247

Mr. Pedro Roffe
Officer-in-Charge
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9075827
Fax 00 41 22 9170247

Ms. Gloria-Veronica Koch
Chief, Capacity-building Section
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9075690
Fax 00 41 22 9170247

Mr. Vladimir Pankov
Economic Affairs Officer
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9075610
Fax 00 41 22 9170247

Mr. Dieter Koenig
Scientific Affairs Officer
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9075661
Fax 00 41 22 9170247

Ms. Dominique Borvo
Secretary
Division for Science and Technology
UNCTAD
Palais des Nations
1211 Geneva 10 - Switzerland
Tel 00 41 22 9076304
Fax 00 41 22 9170247